

AMENDMENT TO THE CLAIMS:

This listing of claims will replace all prior versions of claims in the application:

LISTING OF CLAIMS:

1. (Previously Presented) An apparatus comprising:

a substrate having at least one aperture having a tapered portion with a top diameter greater than a bottom diameter and wherein in each said at least one aperture, the tapered portion of each said at least one aperture transitions into a cylindrical portion having a diameter equal to said bottom diameter of said tapered portion;

cross-linkers attached to an inner wall of said at least one aperture; and

a macro-cyclic ring, having a diameter substantially the same as the diameter of the cylindrical portion of said at least one aperture, attached at or near the circumference of one end of the cylindrical portion of said at least one aperture.

2. (Original) The apparatus of claim 1, wherein the substrate is chosen from the group consisting of glass, carbon, polymeric materials, and semiconductors.

3. (Original) The apparatus of claim 1, wherein the macro-cyclic ring has a rigid phenylethynyl backbone.

4. (Original) The apparatus of claim 1, wherein a biological or chemical probe is attached to the macro-cyclic ring such that the biological or chemical probe extends into and rests between at least a portion of the surfaces of the inner walls of the cylindrical portion of said aperture.

5. (Original) The apparatus of claim 4, wherein the biological probe comprises a single strand sequence of DNA.
6. (Previously Presented) The apparatus of claim 1, wherein the substrate comprises a layer of Silicon Nitride, a layer of Silicon, a layer of Silicon Oxide, a layer of Silicon, and a layer of Silicon Nitride.
7. (Previously Presented) An apparatus comprising:
 - a substrate having at least one aperture having a tapered portion with a top diameter greater than a bottom diameter and wherein in each said at least one aperture, the tapered portion of each said at least one aperture transitions into a cylindrical portion having a diameter equal to said bottom diameter of said tapered portion;
 - cross-linkers attached to an inner wall of said at least one aperture; and
 - antibodies or chemical functional groups deposited around the inner walls of said at least one aperture or around the circumference of one end of said at least one aperture.
8. (Original) The apparatus of claim 7, wherein the substrate is chosen from the group consisting of glass, carbon, polymeric materials, and semiconductors.
9. (Previously Presented) The apparatus of claim 7, wherein the substrate comprises a layer of Silicon Nitride, a layer of Silicon, a layer of Silicon Oxide, a layer of Silicon, and a layer of Silicon Nitride.
10. (Withdrawn) A method comprising:
 - providing a substrate having at least one aperture having a tapered portion with a top diameter greater than the bottom diameter and wherein the

tapered portion of the aperture transitions into a cylindrical portion having a diameter equal to said bottom diameter of said tapered portion; and
functionalizing said aperture to bind to a specific biological or chemical moiety.

11. (Withdrawn) A method comprising:

providing a substrate having at least one aperture having a tapered portion with a top diameter greater than the bottom diameter and wherein the tapered portion of the aperture transitions into a cylindrical portion having a diameter equal to said bottom diameter of said tapered portion, wherein said aperture is functionalized to bind to a specific biological or chemical moiety; and

passing a sample through said aperture while simultaneously measuring the variation in ionic current across the depth of said aperture.

12. (New) The apparatus of claim 1, wherein the macro-cyclic ring has at least one functional group coupled thereto.

13. (New) The apparatus of claim 1, further comprising electrodes positioned to allow measurement of a current across the aperture.

14. (New) The apparatus of claim 13, further comprising a device coupled to the electrodes for measuring the current across the aperture.

15. (New) The apparatus of claim 14, wherein coupling of a biological or chemical material to a functional group coupled to the macrocyclic ring causes a change in the current across the aperture, the change being detectable by the device.

16. (New) The apparatus of claim 7, further comprising electrodes positioned to allow measurement of a current across the aperture.
17. (New) The apparatus of claim 16, further comprising a device coupled to the electrodes for measuring the current across the aperture.
18. (New) The apparatus of claim 17, wherein coupling of a biological or chemical material to the antibodies or chemical functional groups causes a change in the current across the aperture, the change being detectable by the device.